10.213 Fall 1998

Problem 18 (due Monday, November 1)

At a fixed temperature, the molar density (moles/cm^3) of many binary solutions as a function of the mole fraction of the first component, x_1, follows the empirical relationship:

$$\rho = A + B\, x_1 + C\, x_1^2$$

For the mixture of interest here at 300 K, A = 0.02, B = -0.01, and C = 0.005.

a) Make a V-x_1 diagram, indicating the values given above.
b) Determine the best values of the coefficients A, B, and C for the water/ethanol mixtures at 300 K.
c) Determine the partial molar volumes of water and ethanol for a solution which is 20 weight % water.
d) How many liters of pure water must be added to one liter of a solution which is 44 weight % water to achieve a final solution which is 20 weight % water?
e) What is the extensive volume of the final solution described in part (d)?
f) What is the intensive excess volume of the final solution describe in part (d)?

Convert all data to mole fractions and intensive molar volumes